SURGICAL TREATMENT OF OBSTRUCTIVE SLEEP APNEA - CASE REPORT

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Abstract: Obstructive sleep apnea (OSA) is characterized by repetitive episodes of nocturnal breathing interruption due to partial or complete upper airway collapse, mainly the oropharyngeal tract. OSA is known to cause symptoms, such as excessive daytime somnolence, and is associated with cardiovascular morbidity and mortality. Different treatment options are: continuous positive airway pressure (CPAP), nasal CPAP (nCPAP), mandibular advancement devices, and surgery. The purpose of this article was to describe the successful case of a severe OSA case treated by surgical and orthodontic approach.

Keywords: Obstructive Sleep Apnea Syndrome, Maxillofacial surgery, orthodontic treatment

Introduction:

Obstructive sleep apnea (OSA) is a common chronic disorder that affects 2–4% of the adult population, having the highest prevalence among middle-aged men. It is characterized by repetitive episodes of collapse of the upper airway during sleep, with a consequent cessation or reduction of the airflow (1). The apnea or hypopnea, determined by the degree of the obstruction, causes progressive asphyxia so that the desaturation of oxygen makes the individual require increasingly higher respiratory efforts, until he is awoken (1, 2). OSA brings grave consequences such as excessive daytime sleepiness, which can generate traffic accidents. Besides, it may be associated with a significant cardiovascular morbidity and connected with metabolic syndromes. In addition, many patients may describe difficulties in concentration, nightly choking or gasping, nocturnal memory loss and mood swings, irritability and depression causing a great impact on quality of life (3).

According to the American Academy of Sleep Medicine, the diagnosis of OSA is given through the analysis of clinical history, physical, radiographic and polysomnographic examinations. This last one consists of the evaluation of nighttime cardiac and respiratory parameters during sleep, aiming to detect obstructive events and alterations in the saturation of oxygen in the blood. The gold standard for diagnosis is a polysomnography (PSG) or overnight sleep study. In regard to OSA, a PSG

calculates the number of obstructive airway events per hour of sleep, known as the apnea-hypopnea index (AHI). An AHI < 5 is considered normal. An AHI between 5 and 15 is mild OSA; 15 to 30 AHI is moderate OSA, and an AHI > 30 indicates severe OSA (4, 5).

The first choice of treatment for patients with moderate or severe obstructive sleep apnea is continuous positive airway pressure (CPAP), which was first described in 1981 by Sullivan et al. and works by splinting the airway open to facilitate proper airflow (6). However, some patients are intolerant to this treatment, claiming discomfort when using the mask, while others do not accept sleeping while connected to a mechanical device (7). In these cases, surgical treatment must be considered, whose objective is the removal of the cause of obstruction of the upper airways, enlarging the lumen after a precise detection of the place where the obstruction occurs. The most common sites of obstruction are the oropharyngeal tract (collapse of the retro palatal and retro lingual regions due to macroglossia, low-lying soft palate or enlarged tonsils) and the nose (congestion, polyposis, chronic rhinitis) (1).

Maxillomandibular advancement (MMA) is a result of maxillary and mandibular osteotomy. The advancement of the skeleton structures passively induces an anterior displacement of the soft palate and the tongue with a simultaneous widening of the pharyngeal space (8). MMS is a highly effective treatment, after MMS, a mean reduction in AHI of 87% has been reported and there is general consensus that this represents the most effective surgical approach after tracheotomy (8, 9). However, it is noteworthy that MMS is an extremely invasive treatment, often associated with complications and aesthetic sequelae. Therefore, the treatment should be reserved for selected patients when all other approaches and first-level surgery have failed or patients with established craniofacial malformations (10).The candidates for MMA surgery include adults and adolescents whose ossification of cranial structures is complete with moderate or severe OSA (AHI>15), with prior failure or no toleration of other therapeutic interventions, such as upper airway surgery, MAD, or CPAP and with craniofacial abnormalities (e.g., micrognathia or Maxillomandibular hypoplasia) (11,12,13).

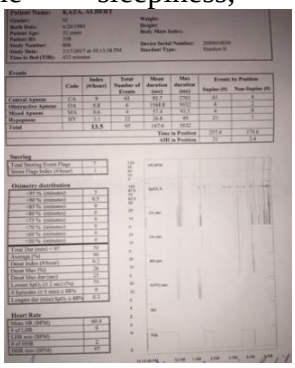
Case report

Patient A.K, male, age 42, diagnosed with a class II skeletal, with mandibular retrognathia, slight mandibular asymmetry to the right, class II/2 Angle, with deep bite and increased over-jet (Fig. 1a, 1b, 1c, 1d, 1e).

Fig. 1a Fig. 1b Fig. 1c


Fig.1d Fig.1e

Polysomnography revealed an AHI of 23.4, moderate sleep apnea (fig. 2a). These data associated with the physical examination, clinical history of signs and symptoms (daytime sleepiness, concentration difficulties, frequent headaches) and with the cephalometric and CBCT evaluation, confirm the diagnosis of sleep apnea (fig.2b, 2c).



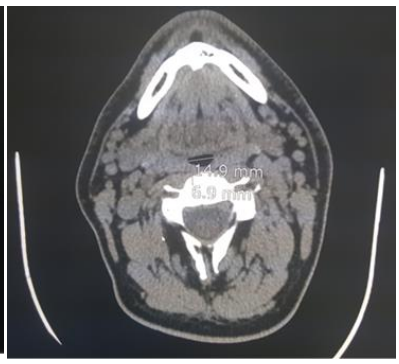


Fig. 2a Fig. 2b Fig. 2c

The treatment of choice was Bimaxillary Advancement Surgery, considering that the patient had not accepted a conservative, palliative treatment with CPAP. As orthodontic presurgical planning, a Roth fixed metallic orthodontic appliance was installed. The treatment lasted 5 months. Continues arch was used for the upper jaw and segmented arch for the lower jaw to not inverse the Spee curve (Fig. 3a, 3b).


Fig. 3a Fig. 3b

Before undergoing the surgical treatment, passive form rectangular steel arch wires 0.019”x0.025” with individual spurs and ligatures were installed (Fig. 4a, 4b, 4c).



Fig. 4a Fig. 4b Fig. 4c

The models were mounted in semi-adjustable articulator for model surgery and confection of surgical models based on the measurements of the predictive surgical tracing (10 mm maxillary advancement with a 2 mm impaction of the anterior nasal spine, 3 mm lowering of the posterior nasal spine and 15 mm mandibular advancement with counter-clockwise rotation of the occlusal plane), which was carried out together with the surgeon (Fig 5a, 5b).


Fig 5a Fig. 5b

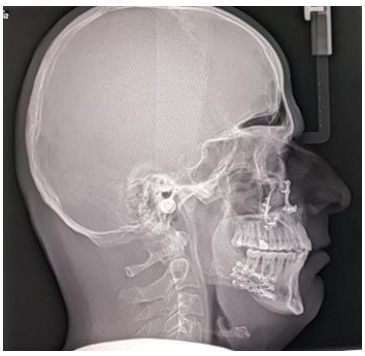
Results

Ten days after surgery, the patient returned to the office for occlusion examination and guidance in the use of intermaxillary elastics (Fig 6a, 6b, 6c).



Fig. 6a Fig. 6b Fig. 6c

During this postoperative period, the patient was already reporting an improvement in the quality of his sleep and, therefore, a considerable gain in his general well-being. The improvement in the flow of air through the posterior superior air column was observed in postsurgical lateral teleradiography and CBCT and the cure of OSA was confirmed, six months later, through control polysomnography which showed an AHI of 3.2 events/hour of sleep, minimal oxyhemoglobin saturation of 91% and an average of 96.8% (Fig. 7a, 7b, 7c).



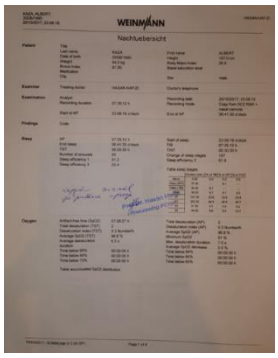



Fig. 7a Fig. 7b Fig.7c

Orthodontic treatment extended for 6 months after surgery, in order to refine occlusion (Fig. 8a, 8b, 8c).



Fig. 8a Fig.8b Fig. 8c

Retainers for both jaws were installed and the balance between masticatory, respiratory function and facial aesthetics was reached, considering that the subject's profile remained quite harmonious (Fig. 9a, 9b, 9c).



Fig. 9a Fig. 9b Fig.9c

Discussions

There are some options for the medical treatment of OSA, including Continuous Positive Air Pressure (CPAP) appliances, Bi-level Positive Airway Pressure (BIPAP) devices, intraoral devices MAD, as well as weight loss. The CPAP nasal device is used for the pneumatic support of the upper airway. A non-surgical alternative which uses a mask, a tube and a flow generator but, in spite of being widely used, it does not offer a cure since a night without it makes all the quality of sleep obtained through its use disappear (14,15).

Likewise, combined maxillary and mandibular advancement orthognathic surgery has been the chosen procedure in the treatment of respiratory disorders in order to make the patient free from the use of any mechanical devices. Countless studies report the benefits of orthognathic surgery for mandibular advancement in the upper airway and the association with the counter-clockwise rotation of the occlusal plane. When properly performed,it is a stable procedure in the long term and maximizes the aesthetic function after surgery even in patients who already have a straight facial profile (1,14).

According to Holty and Guilleminault, (12) who performed a meta-analysis of 22 studies of MMA describing 627 adults with OSA, MMA is a highly effective and safe treatment for OSA in adults. They found the surgical success rate (AHI<20 and ≥50% reduction in OSA) to be 86.0% and the surgical cure rate (AHI<5) to be 43.2% postoperative. Another meta-analysis of MMA treatment in OSA patients also observed a reduction in AHI and an increase in the oxygen saturation, indicating treatment success (16). Most OSA patients report subjective satisfaction after MMA with improvement in OSA symptomatology (excessive daytime sleepiness, morning headache, memory loss, and impaired concentration) as well as in qualities of life measures (12). A cohort study on the long-term effectiveness and safety of MMA for the treatment of OSA showed successful outcomes with minimal long-term treatment-related adverse outcomes (13).

Conclusions

OSA has arisen as the most frequent and important sleep disorder while connecting to several systemic alterations. Currently maxillomandibular advancement osteotomies are the only interventions where the results are comparable with those of CPAP (reference treatment) with a success rate of approximately 80%, which varies depending on the selected criteria. ENT and orthodontic treatment in preparation for surgery is generally necessary. Treating OSA requires a holistic and multidisciplinary approach. This involves not only surgeons but also dentists, orthodontists, and other members of paramedical specialties such as lingual rehabilitation, psychotherapy, sophrology, osteopathy, and dietetics. Some researchers do propose possible predictors of treatment success, but clear patient selection criteria and clinical predictive values for treatment success are still needed in both treatment modalities.

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